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ABSTRACT

Discussed is a research study comparing the relationship between the attitudes toward arithmetic of students and their teachers in grades 3, 5, and 6. The subjects were 1022 students and 39 teachers in a middle-class area in the northeastern section of Cleveland, Ohio. The students and their teachers were given a 28 item attitude toward arithmetic instrument. The research design was a 3 x 2 x 2 analysis of variance model. The independent variables were (1) teacher attitude (high, middle, low); (2) grade level (3, 5, and 6); and (3) sex of student. The dependent variable was the mean classroom attitude score calculated separately for the two sexes. The results showed no significant relationships between teacher and student attitudes. However, there was a significant difference ($p<.01$) among the three grade levels. In fact, Scheffe's tests revealed a definite decrease in students' attitudes toward arithmetic with significant differences occurring between grades 3 and 6 and grades 5 and 6. In both cases the mean attitude favors the earlier grade. (Author/CT)

AN EXPLORATION INTO TEACHER AND STUDENT ARITHMETIC ATTITUDE AT GRADES 3, 5, and 6

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INTRODUCTION

In his book, Mager (1968) has emphasized the importance of attitude in the learning process. According to Mager, in addition to teaching students skills and knowledge in a subject field one of the important goals of instruction is to prepare the student to learn more about the subject. This goal is operationalized in terms of an approach and avoidance model, i.e., the learner should leave the study of the discipline with a tendency to approach rather than avoid future work. Clearly, Mager stresses that an essential part of teaching is having the students leave the teacher's influence with as favorable an attitude as possible toward the subject.

Recently, Aiken (1969) has reviewed approximately 100 articles written in the past ten years that are concerned with attitudes toward mathematics and arithmetic. Although Aiken cites the many studies done in this period, he is critical of the methodology of many of them and calls for more work to be done in order to obtain more definitive answers as to the importance of attitudes in the learning of mathematics and arithmetic. In addition, Romberg (1969) takes a similar stand when he states that the precise role which attitudes play in the learning of mathematics and arithmetic is not at all understood, and in a more severe vein looks at any research in the area as fruitless. Yet, mathematics educators such as Glennon and Callahan

(1968), Shyrock (1963) and Shipp and Adams (1964) have all emphasized the importance of the attitudes toward arithmetic of the elementary school teacher as a conditioner of the attitudes of his or her students. Aiken also highlights the importance of teacher attitude in a section of his review but cites little empirical work to support the position that teacher and student attitude in arithmetic are related. Obviously, more data based work is needed before this relationship is substantiated.

Another aspect of arithmetic attitude research which has recently been highlighted has been a decline in students' attitudes toward arithmetic beginning in the elementary school years [Neale (1969), Neale, Noel, and Tismer (1970), Anttonen (1967, 1969) and Ryan (1968)]. All of the above studies report decreases in students' attitudes which are significant with the range of the work extending from a single elementary school year (Neale et. al.) to a six year period from late elementary school to late secondary school [Anttonen (1967)]. Somewhat contrary findings are reported by Dutton (1968) who found in a followup to an earlier study that there was a decline in the number of students expressing negative attitudes toward arithmetic. However, Dutton also reported that a "sizable" percentage of the students still expressed insecurity when dealing with the subject. In addition, a study by Mastantuono (1970) also supports the position of no decline in students' attitudes at the elementary level as no significant differences in arithmetic attitude were observed

between grades 3 and 5. Clearly more empirical research is needed to examine in the elementary school years the possibility of a decline in the attitudes of students.

Therefore, the present cross-sectional study will explore the relationship between the attitudes toward arithmetic of students and their teachers. In addition, the study will also look at the possible differences in arithmetic attitudes of students at different elementary school grade levels.

PROCEDURE

Subjects: The present study involved 1022 students and 39 teachers in grades 3, 5, and 6 of six elementary schools of a large district in the northeastern area of greater Cleveland, Ohio. The district is predominantly middle-class with an average family income of $12,000 per year. For a distribution of the students involved in the thirteen third grade, fourteen fifth grade and twelve sixth grade classes see Table 1.

Data Collection and Instruments: In December, 1968, teachers and principals involved in the present investigation were asked to participate in a study designed to investigate students' and teachers' attitudes toward arithmetic. At this time an arithmetic attitude scale was presented and its administrative procedure outlined. It was decided that the classroom teachers would administer in early March, 1969, the test during an arithmetic class period. Before the

actual testing the teachers received a set of standardized instructions and were encouraged to tell students to respond honestly since their responses would have no bearing on their grades or schoolwork. In addition, teachers were invited to respond to the same questionnaire with the assurance that their responses would be kept confidential. However, fourteen teachers chose not to complete fully the questionnaire.

The arithmetic attitude scale employed in the present research was a 28 item yes-no scale (See Table 2) adapted by means of factor analysis from a 94 item scale developed by Dr. Cyril J. Hoyt (Anttonen, 1967). Each of the items in the scale refers to typical student experiences with arithmetic, e.g., liking arithmetic, liking arithmetic class, liking arithmetic homework, and subjects are to answer either yes or no to each of the questions. The items are scored by assigning "1" to a favorable response and "0" to an unfavorable response; a score for a subject is obtained by simply adding across the twenty-eight items.

Data Analysis: In order to explore the relationship between teacher and student attitude and to examine the arithmetic attitudes of students at various elementary school grade levels, a 3X3X2 crossed analysis of variance model was utilized. The independent variables involved were teacher attitude (high, middle, and low); grade level (3, 5, and 6); and sex of student. The dependent variable was the mean classroom attitude score calculated separately for the two sexes.

The classification of teachers into high, middle, and low attitude groups was based on an analysis of the distribution of the total scores for the 39 teachers. As a result of this analysis, teachers whose scores were 25 or above were classified as having high attitudes, teachers with scores between 24 and 16 were classified as having middle attitudes, and teachers with scores below 16 were classified as having low attitudes. In Table 3 is a frequency breakdown of the three teacher attitude levels for each of the three grades.

RESULTS

The results of the 3X3X2 analysis of variance are presented in Table 4 and the means for the 3 main effects are given in Table 5. As Tables 4 and 5 show there were no significant teacher opinions or sex differences. Also any interaction involving the teacher opinion failed to reach statistical significance. Therefore, the theorized relationship between the attitudes toward arithmetic of students and the attitudes of their teachers was not substantiated by the present data. However, the results of the analysis revealed a significant difference at the .01 level (F= 12.845) between the three grade levels. This difference was examined further by means of a Scheffé test. In Tables 5 and 6 are presented the means and the results of the Scheffé's analysis. As Table 6 shows there is a definite decrease in students' attitudes toward arithmetic in the elementary grades with significant differences occurring between grades 3 and 6

and grades 5 and 6. In both cases the mean attitude score favors the earlier grade. The results of the Scheffe test for the difference between 3 and 5 while not significant show a higher mean attitude for grade 3. Thus, the present study supports the position that attitudes toward arithmetic decrease in the elementary school grades.

DISCUSSION

The results of the present study do not support the general expressed belief that there is a relationship between arithmetic attitudes of students and teachers. Clearly the methodology employed in the present investigation could have contributed to the lack of a significant difference as there was no definite attempt to look at a causal relationship between the attitudes of students and teachers. More specifically, students feelings may have already been developed before they were exposed to their particular classroom teacher, and hence their attitudes may not have been affected by their present experiences with arithmetic. Also, the manner of measuring the teacher attitude toward arithmetic may have been limited by not only the social desirability factor so often involved in the present type of research, but also by the possible non-appropriateness of having teachers respond to an attitude instrument identical to that of students.

However, the work of Neale et. al. showing a decline in the arithmetic attitudes of elementary school children finds support in this investigation. The significant decrease in students' attitudes

across the three grade levels highlight the importance of finding educational methods in arithmetic to enhance student attitudes. While an argument has been advanced by Neale stating that the contribution of arithmetic attitude toward arithmetic achievement is minimal, the fact still remains that the attrition rate between elementary school and secondary school in the "electing" of mathematics courses is typically high (Anttonen, 1967). Although it is possible to assume this attrition to be a natural phenomenon of subject specialization, there is, as Bradfield (1970) has indicated, a great educational waste both to the student and to society in the students' avoidance of mathematics courses. Possibly through efforts such as individualized instruction and mathematics games at the elementary school level more students can become interested in continuing in mathematics. Perhaps, with the recent emphasis on the cognitive skills the affective element must be rediscovered and as espoused by Mager become an essential part of arithmetic instruction.

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TABLE 1

DISTRIBUTION OF NUMBER OF STUDENTS

BY GRADE AND SEX

		Grade			
		3rd	5th	6th	Total
Sex	Male	185	162	179	526
	Female	193	157	146	496
	Total	378	319	325	1,022

TABLE 2

28-Item Hoyt Scale for Measuring Arithmetic Attitude

1.	Do you think arithmetic class is fun?	yes	no
2.	Do you usually hate arithmetic?	yes	no
3.	Do you like most of the work in arithmetic?	yes	no
4.	Do you feel sorry when you miss arithmetic class?	yes	no
5.	Do you often wish arithmetic class would be shorter?	yes	no
6.	Is it hard for you to start doing your arithmetic homework?	yes	no
7.	Have you always liked arithmetic?	yes	no
8.	Do you like to miss arithmetic class?	yes	no
9.	Do you sometimes wish you had more hard problems in arithmetic?	yes	no
10.	Do you often wish your arithmetic class would be longer?	yes	no
11.	Do you hate to start doing your arithmetic homework?	yes	no
12.	Do you like the easy problems best in arithmetic?	yes	no
13.	Do you think most of your other subjects are easier than arithmetic?	yes	no
14.	Would you take arithmetic next year if you did not have to?	yes	no
15.	Is arithmetic one of your favorite subjects?	y	
16.	Do you like arithmetic the best of all your school work?	yes	
17.	Is arithmetic interesting for you?	yes	no

18.	Is it easy for you to begin doing your arithmetic assignment?	yes no
19.	Do you always wish arithmetic class would be shorter?	yes no
20.	Do you dislike most of the work in arithmetic?	yes no
21.	Is arithmetic hard for you?	yes no
22.	Would you like to study arithmetic during the summer vacation?	yes no
23.	Do you usually like to do you work for arithmetic class?	yes no
24.	Are you glad when it is time for arithmetic class?	yes no
25.	Are you glad when arithmetic class is over?	yes no
26.	Is arithmetic easy for you?	yes no
27.	Do you like the hard arithmetic problems best?	yes no
28.	Do you always wish arithmetic would be longer?	yes no

TABLE 3

DISTRIBUTION OF NUMBER OF TEACHERS IN HIGH, MIDDLE, AND LOW ARITHMETIC ATTITUDE GROUPS FOR GRADES 3, 5, AND 6

		Opinion			
		High	Middle	Low	Total
Grade	3	3	7	3	13
	5	4	7	3	14
	6	3	6	3	12
Total		10	20	9	39

TABLE 4

ANALYSIS OF VARIANCE ON HOYT ARITHMETIC ATTITUDE SCORES
CLASSROOM MEANS AS UNIT OF ANALYSIS

Source	df	MS	F
A (Teacher Attitude)	2	9.977	1.386
B (Grade)	2	92.434	12.845**
C (Sex)	1	.692	-
A X B	4	20.515	2.851
A X C	2	.662	-
B X C	2	14.041	1.951
A X B X C	4	7.178	-
Residual	60	7.196	

** $p < .01$

TABLE 5

MEAN ARITHMETIC ATTITUDE SCORES FOR MAIN EFFECTS

EFFECT	LEVEL	N	$\bar{X}$
Teacher Attitude	High	10	15.57
	Middle	20	15.41
	Low	9	14.24
Grade	3rd	13	16.90
	5th	14	15.57
	6th	12	13.13
Sex	Male	39	15.05
	Female	39	15.32

TABLE 6

SCHEFFÉ TEST FOR DIFFERENCES IN MEAN ARITHMETIC ATTITUDE SCORES FOR GRADE 3, 5, AND 6

Grades		Compared	Mean Difference	Critical Difference
3	and	5	1.33	1.80
3	and	6	3.73**	1.89
5	and	6	2.44 **	1.85

** p < .01